JACKSONVILLE HARBOR DEEPENING STUDY

ECOLOGICAL AND WATER QUALITY MODELING

Presented by:

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Steve Schropp, Senior Scientist, Taylor Engineering, Inc.

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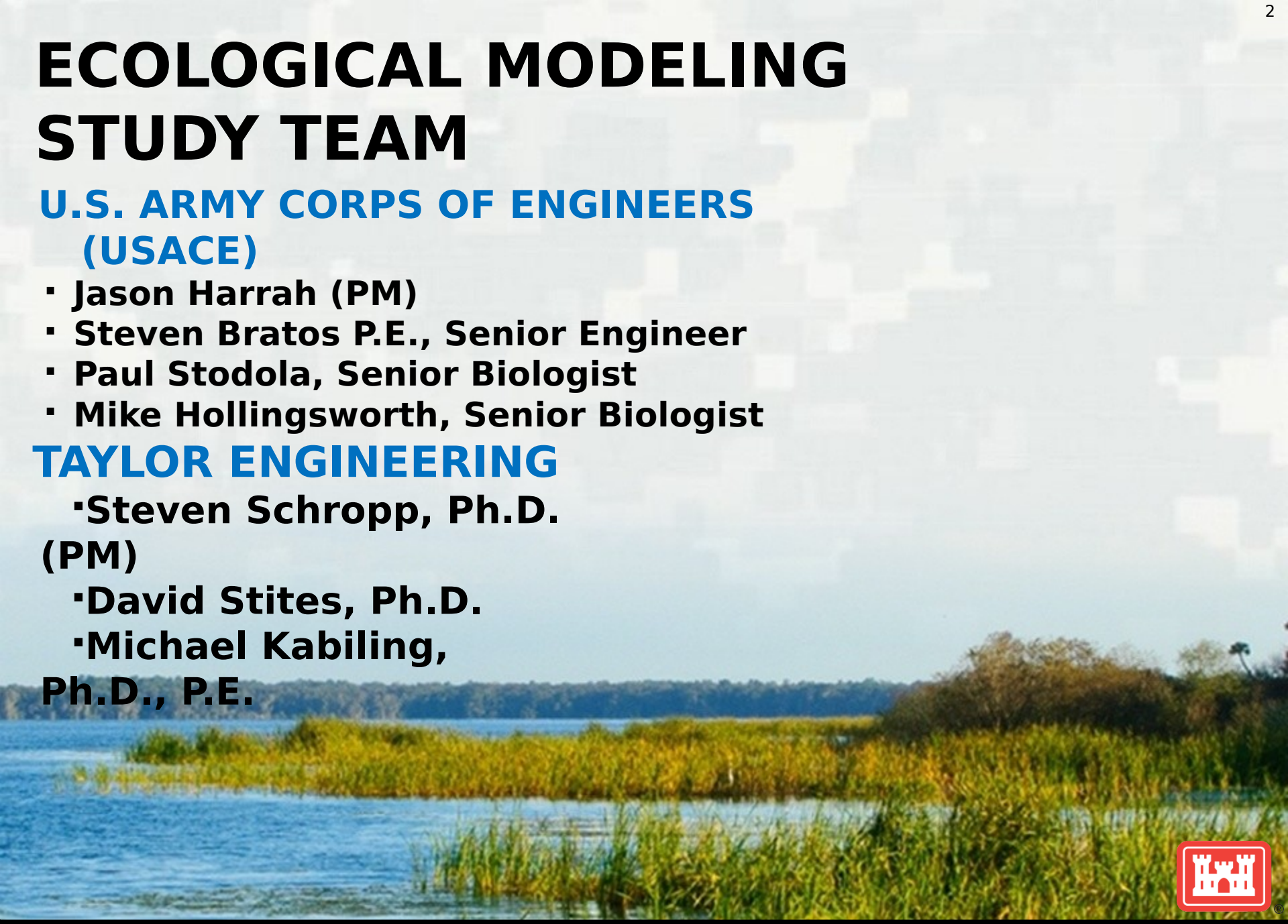
ECOLOGICAL MODELING STUDY TEAM

U.S. ARMY CORPS OF ENGINEERS (USACE)

- Jason Harrah (PM)
- Steven Bratos P.E., Senior Engineer
- Paul Stodola, Senior Biologist
- Mike Hollingsworth, Senior Biologist

TAYLOR ENGINEERING

- Steven Schropp, Ph.D. (PM)
- David Stites, Ph.D.
- Michael Kabiling, Ph.D., P.E.



STUDY OVERVIEW

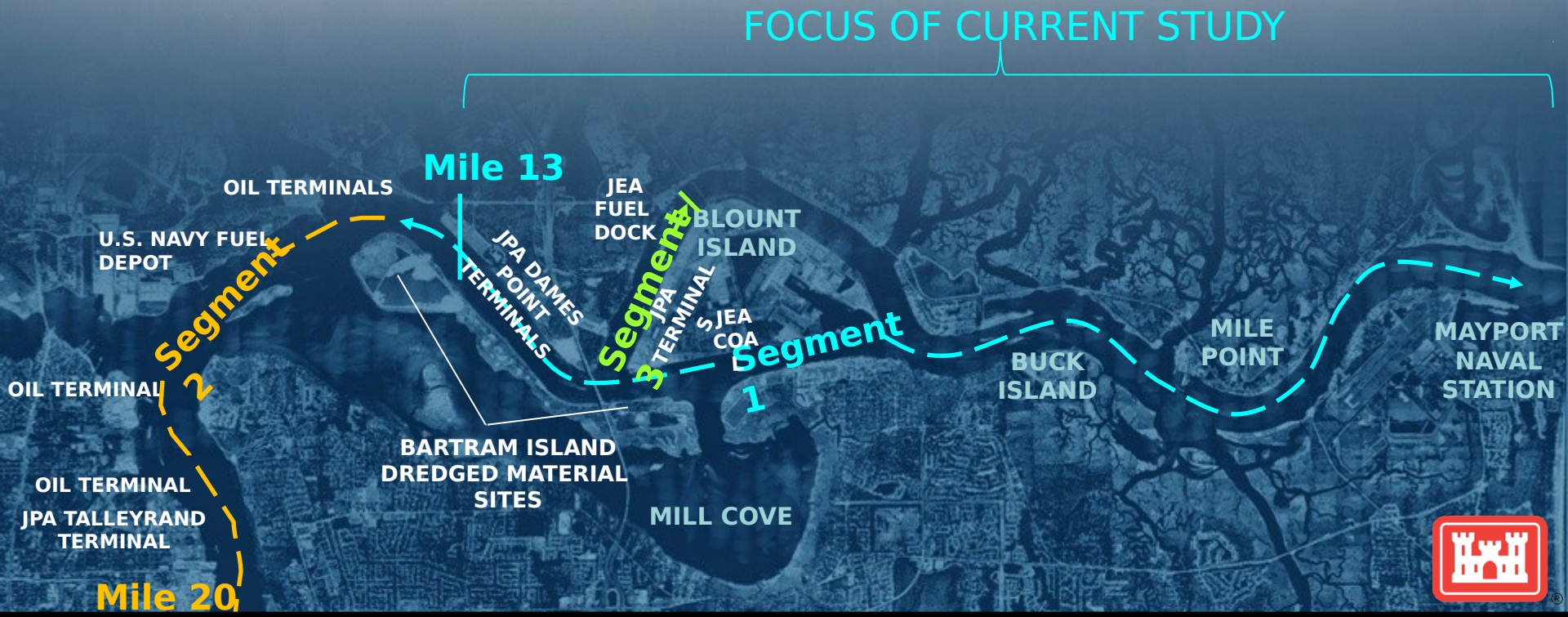
- **Jacksonville Harbor is located in Duval County beginning at the mouth of the St. Johns River where it joins the Atlantic Ocean**
- **The harbor provides access to deep draft vessel traffic using terminal facilities located in the City of Jacksonville**

JACKSONVILLE HARBOR STUDY AREA

Authorized Depths

Segments 1 and 2: 40 feet

Segment 3: 38 feet



STUDY GOALS

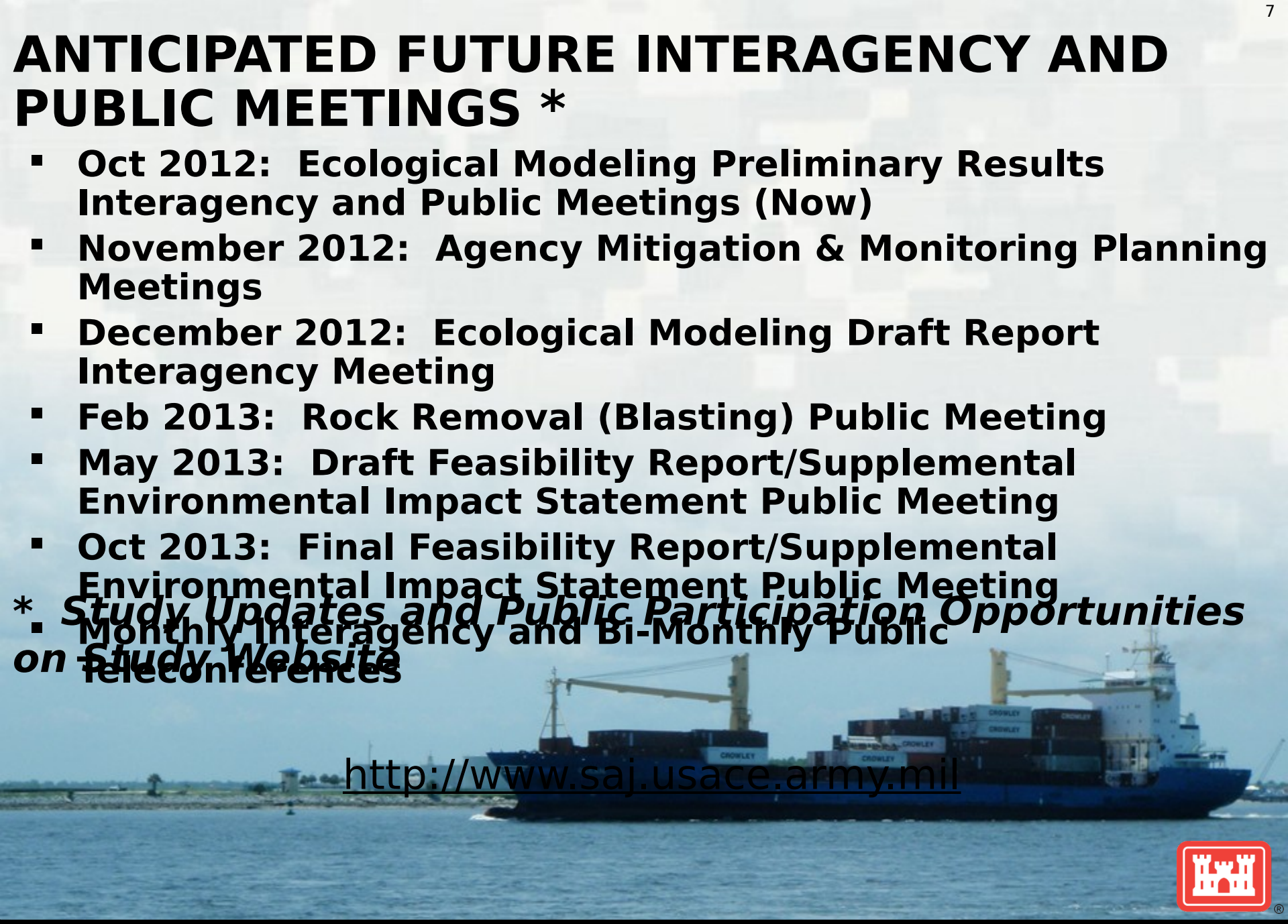
- **Provide transportation costs savings**
- **Develop most cost-effective means for placement of dredged material (over 50-year project life)**
- **Accommodate existing and larger commercial ship traffic while minimizing impacts to environmental resources**

AGENCY AND PUBLIC COORDINATION EFFORTS TO DATE

- May 2007: First Public Scoping Letter
- February 2008: Feasibility Scoping Meeting
- May 2009: Second Public Scoping Letter
- May 2009: Public Workshop on Project Scope
- March 2012: Interagency Meeting on Ecological Modeling
- May 2012: Public Meeting on Ecological Modeling
- July 2012: Initiated Monthly Interagency and Bi-Monthly Public Teleconferences

ANTICIPATED FUTURE INTERAGENCY AND PUBLIC MEETINGS *

- **Oct 2012: Ecological Modeling Preliminary Results Interagency and Public Meetings (Now)**
- **November 2012: Agency Mitigation & Monitoring Planning Meetings**
- **December 2012: Ecological Modeling Draft Report Interagency Meeting**
- **Feb 2013: Rock Removal (Blasting) Public Meeting**
- **May 2013: Draft Feasibility Report/Supplemental Environmental Impact Statement Public Meeting**
- **Oct 2013: Final Feasibility Report/Supplemental Environmental Impact Statement Public Meeting**
- **Monthly Interagency and Bi-Monthly Public Teleconferences**



Study Updates and Public Participation Opportunities on Study Website

http://www.saj.usace.army.mil

STUDY SCHEDULE (President's Initiative)

- April 2013: Draft Feasibility Report w/SEIS Complete
- May 2013: Public Review Period
- Oct 2013: Final Feasibility Report w/SEIS Complete
- April 2014: Chief of Engineers Report
- July 2014: ASA Letter to Congress and Record of Decision
- TBD: Authorization Bill

ECOLOGICAL MODELING OVERVIEW

Purpose

- Support National Environmental Policy Act assessment

Study Area

- River mouth to Lake George
- Deeper channel could increase tidal exchange and cause:
  - Higher salinity in river
  - Changes in water circulation and residence time

ECOLOGICAL MODELING OVERVIEW

Potential effects of salinity and circulation changes

- Wetland communities shift location and acreage
- Loss of eelgrass habitat and shift in habitat location
- Shifts in location of optimal fish salinity ranges and related changes in habitat availability
- Loss of low-salinity benthic macroinvertebrate (e.g., shrimp, crab, clams, mussels, worms) habitat and shift in habitat range
- Changes in plankton blooms and resulting dissolved oxygen

St. Johns River Water Management District Water Supply Impact Study provides ecological model framework

ECOLOGICAL MODELING OVERVIEW

EFDC Model

- Water circulation and salinity

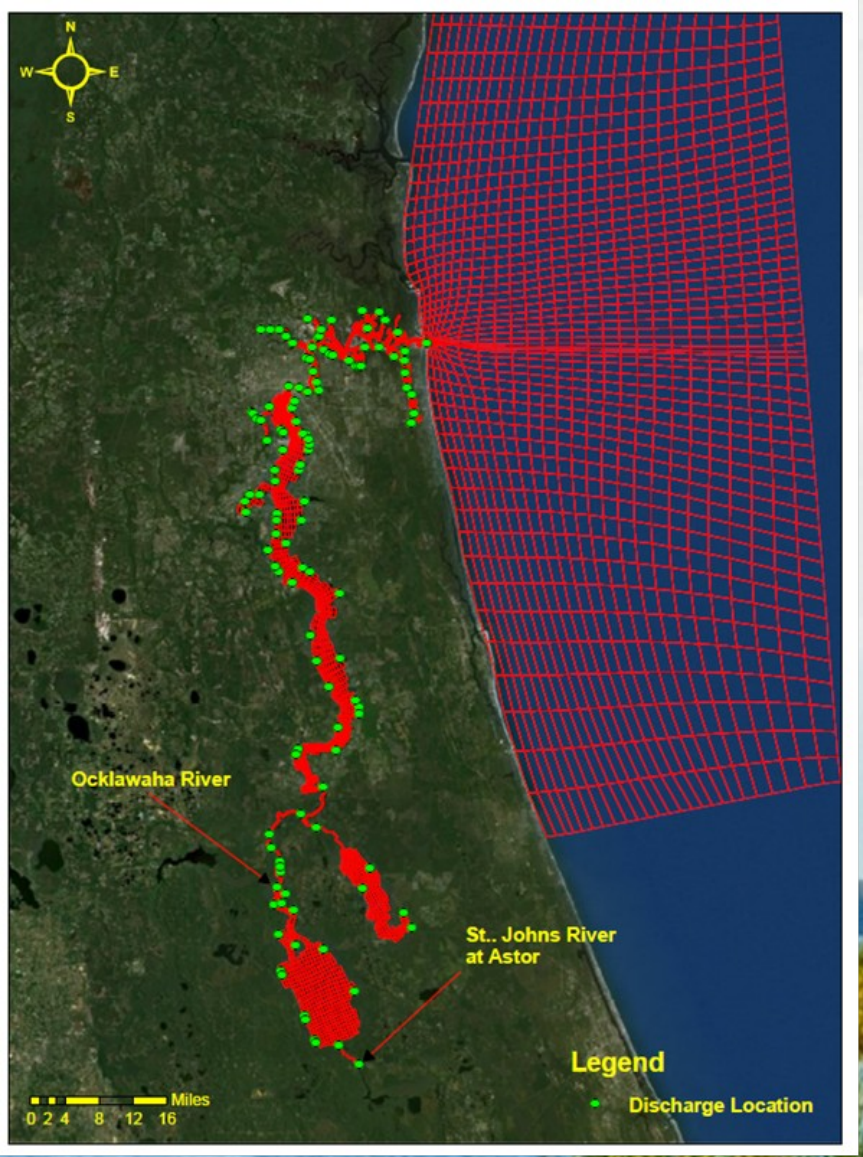
Ecological Models

- Wetland vegetation
- Submerged aquatic vegetation (eelgrass)
- Benthic macroinvertebrates (shrimp, crab, clams, mussels, worms)
- Fish
- Plankton

Water Quality Model

- EFDC/CE-QUAL-ICM

EFDC CIRCULATION AND SALINITY MODEL

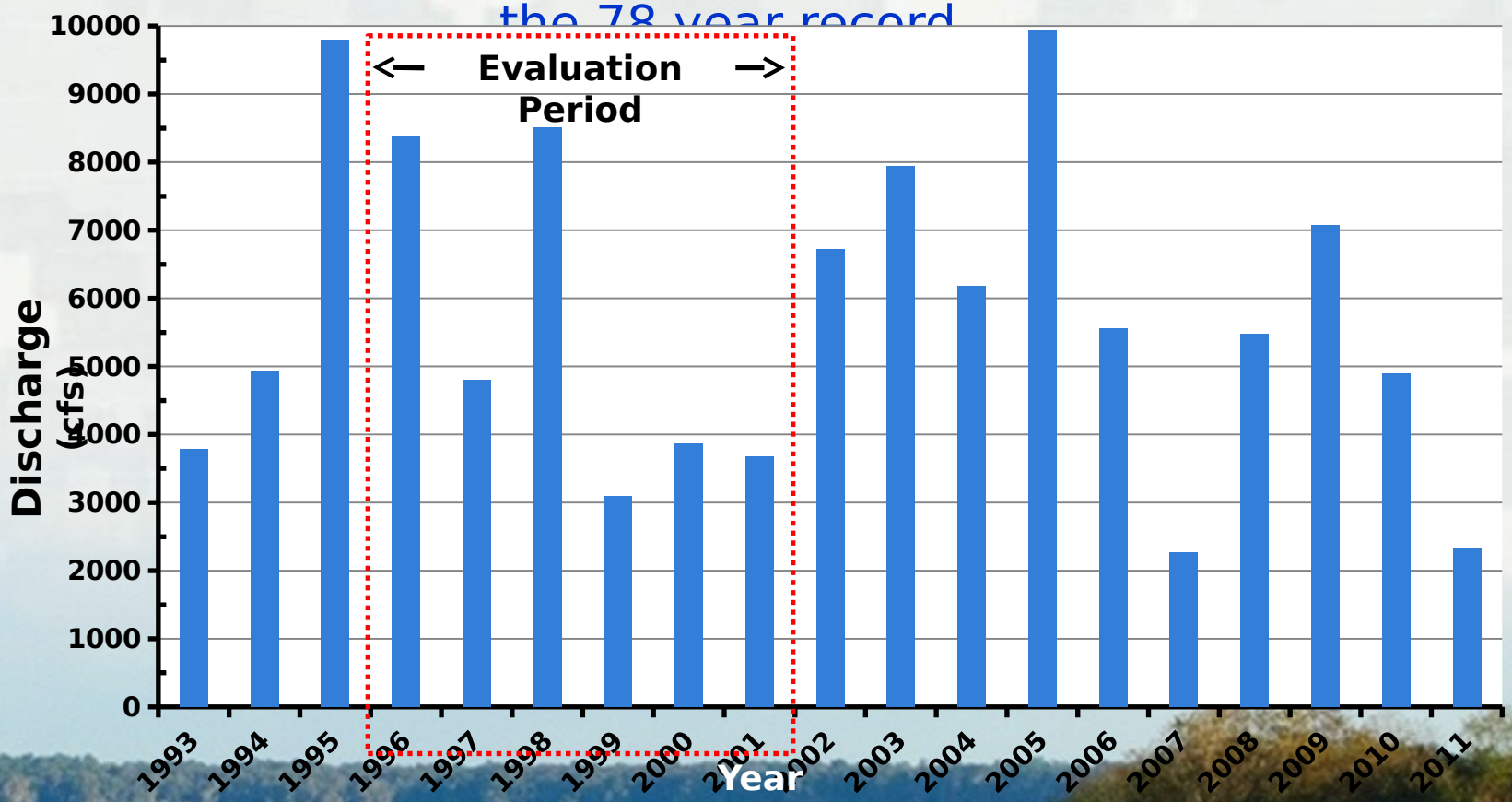


Model conditions and inputs

- 4,824 cells, 6 vertical layers
- Ocean water level
- Rainfall and Evaporation
- Wind
- Salinity
- Lateral inflows
- 1995 land use

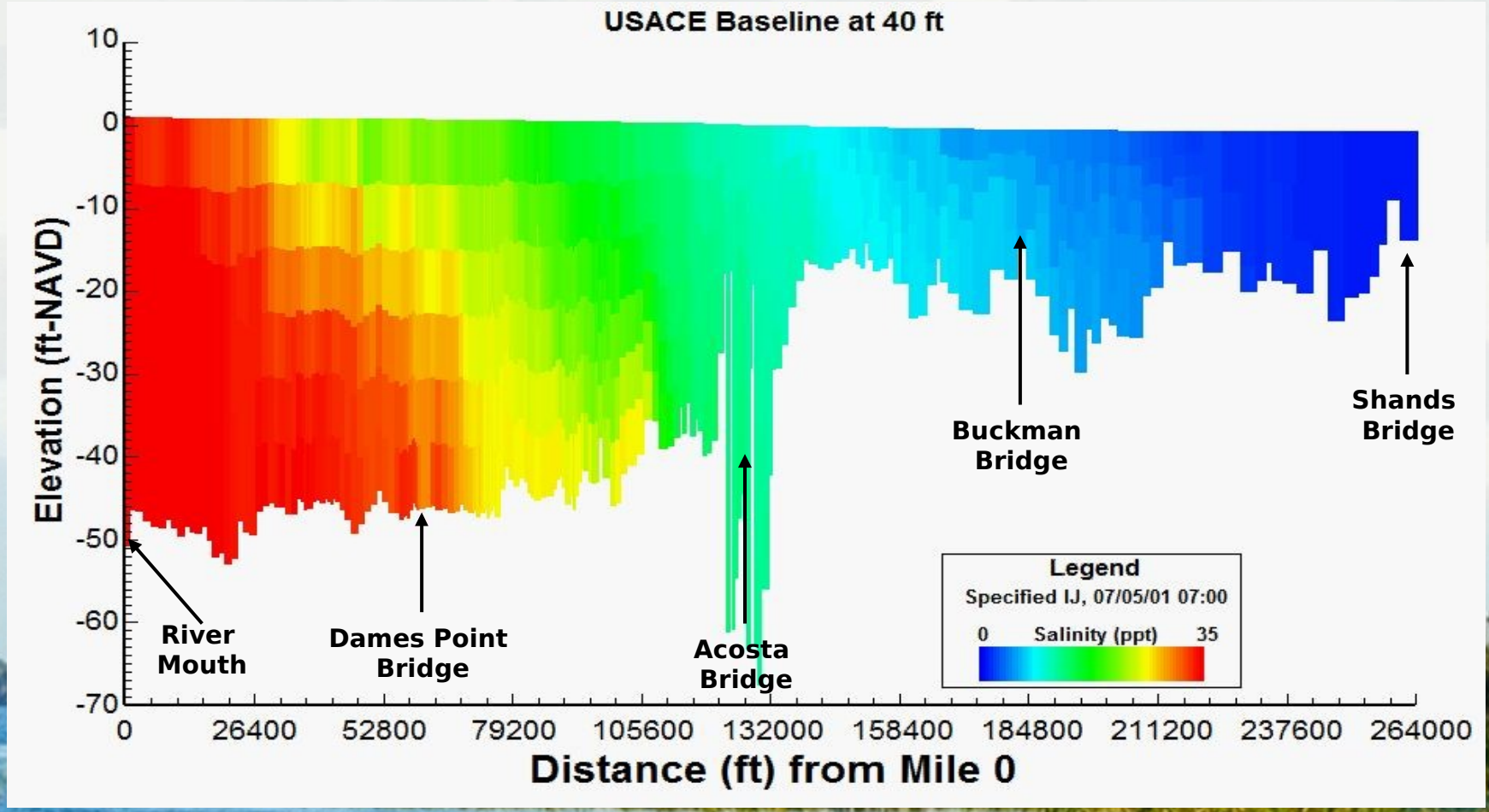
LOWER ST. JOHNS RIVER ANNUAL FLOW

The 3-year period, 1999 - 2001, is lowest 3 consecutive year flow in the 78 year record



EFDC RESULTS

Baseline at 40-foot project depth - salinity profile



WETLAND VEGETATION MODEL

Evaluation Topic

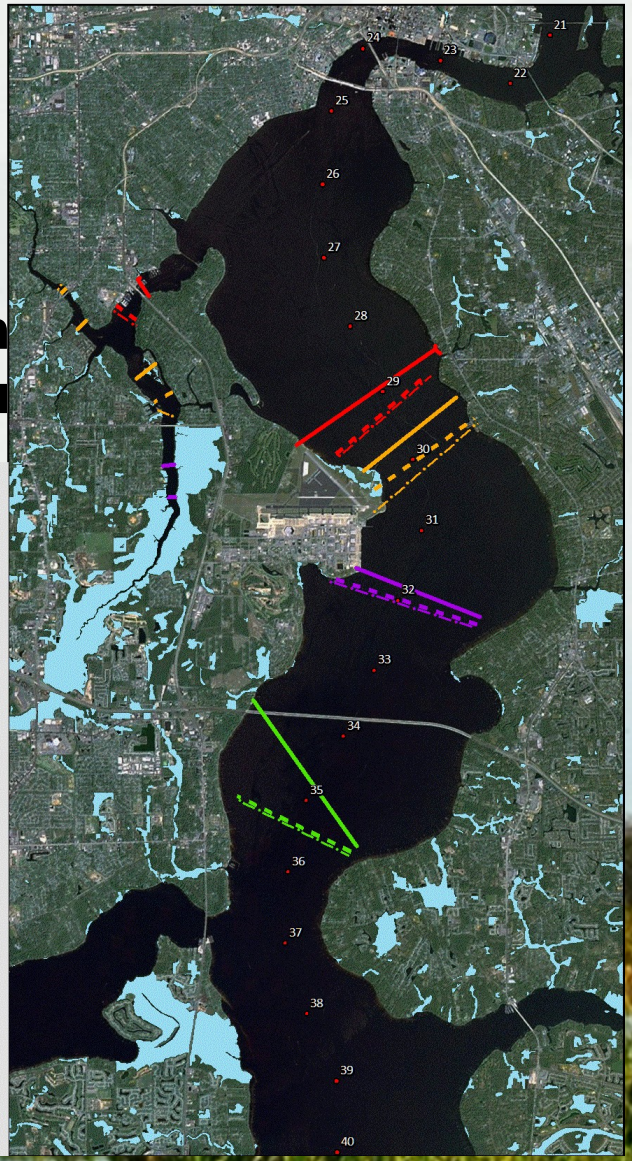
- Wetland (marsh, swamp) shift due to salinity change

Evaluation Method

- Wetland boundaries defined by salinity “break points”
- Modeled salinity movement predicts community boundary and areal change

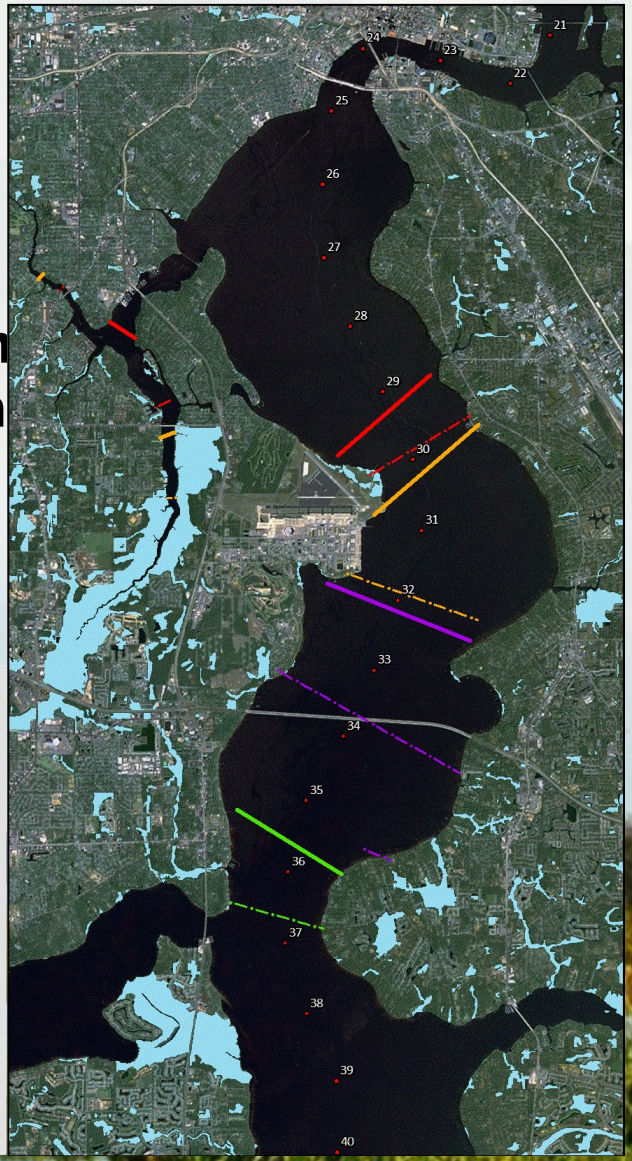
WETLAND VEGETATION MODEL

Salinity Breakpoin
Current Conditio



WETLAND VEGETATION MODEL

Salinity Breakpoin
50-year Horizon



Baseline 50 yr 40 ft
Salinity
3.21
4.13
4.93
5.77
50 yr + 50 ft
Salinity
3.21
4.13
4.93
5.77
River Mile
Wetland 2009

SUBMERGED AQUATIC VEGETATION (SAV) MODEL

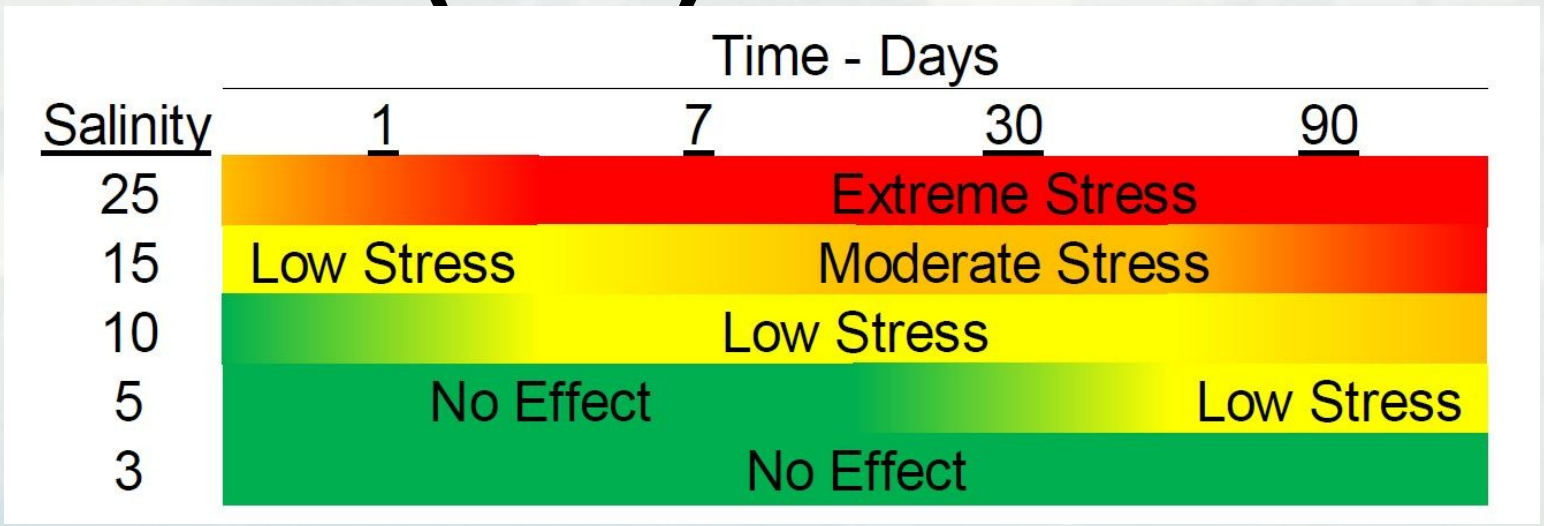
Evaluation Topic

- Salinity stress on eelgrass

Evaluation Method

- 90-day average salinity
- Individual model cells
- Total area affected

SUBMERGED AQUATIC VEGETATION (SAV) MODEL



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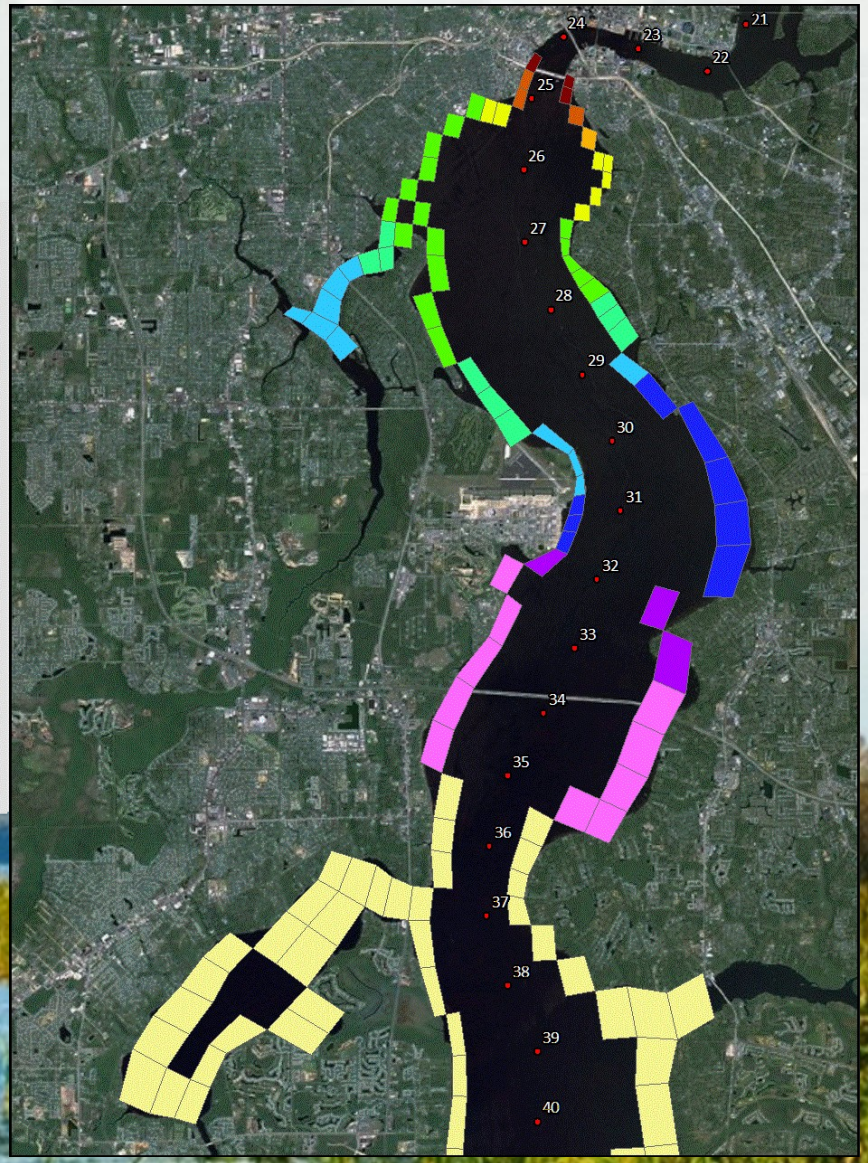


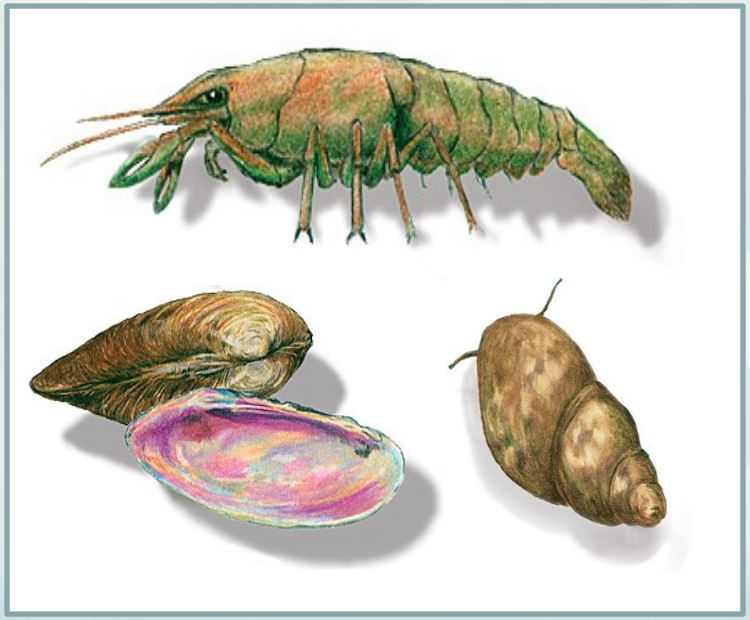
BENTHIC MACROINVERTEBRATE (BMI) MODEL

Evaluation Topic

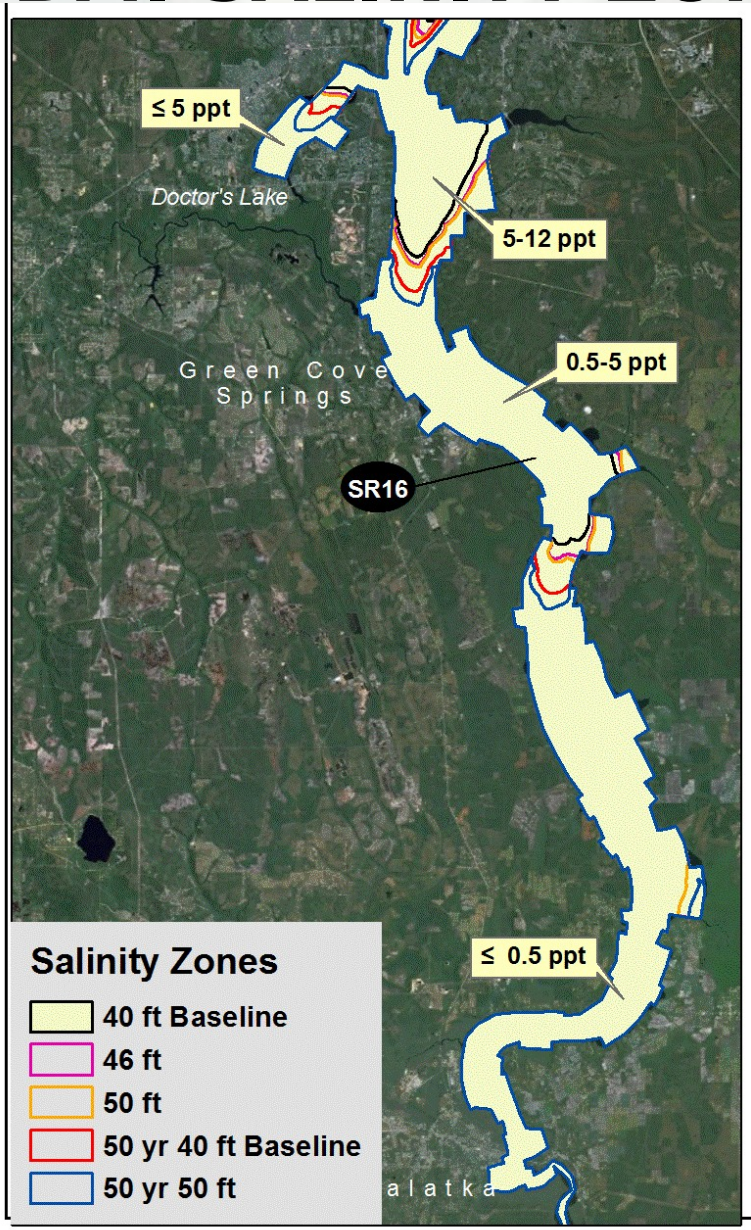
- BMI habitat area and BMI abundance

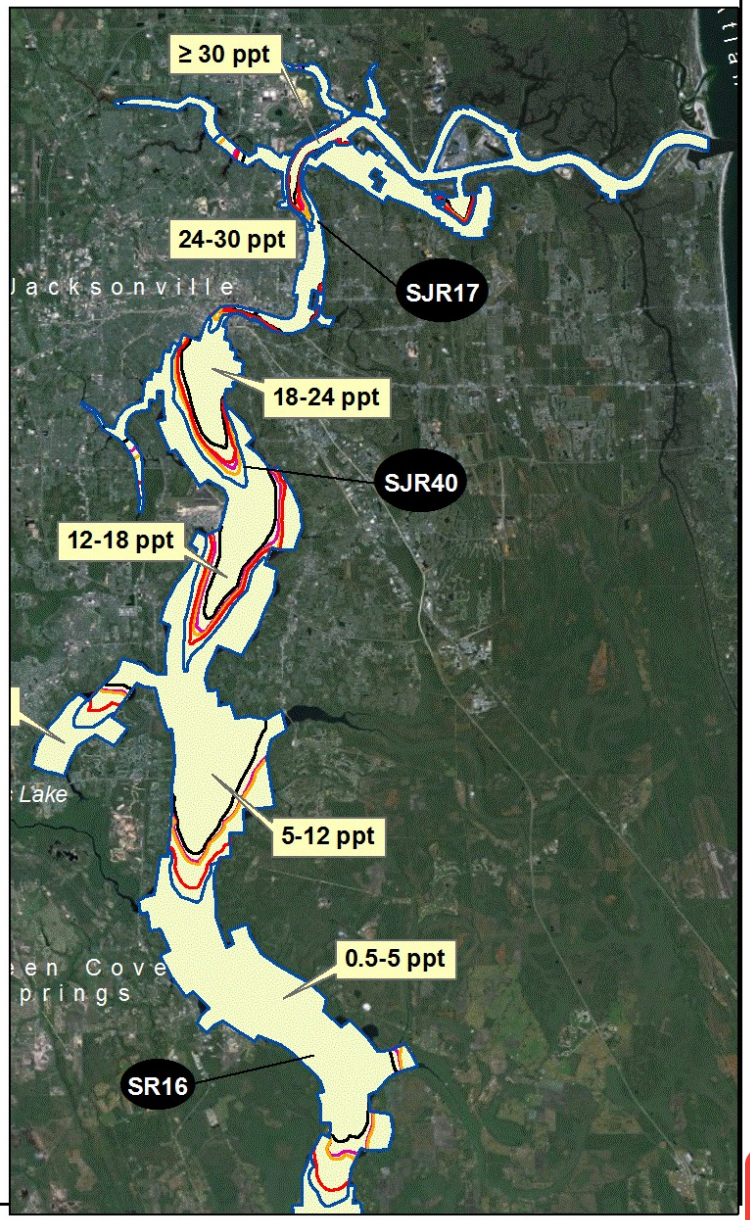
Evaluation Methods

- Changes in area (acres) and location of salinity zones
- Changes in duration and level of salinity (Partial Duration Frequency Analysis – PDFA)
- Total BMI abundance



BMI SALINITY ZONES MAX 30-D, 1997

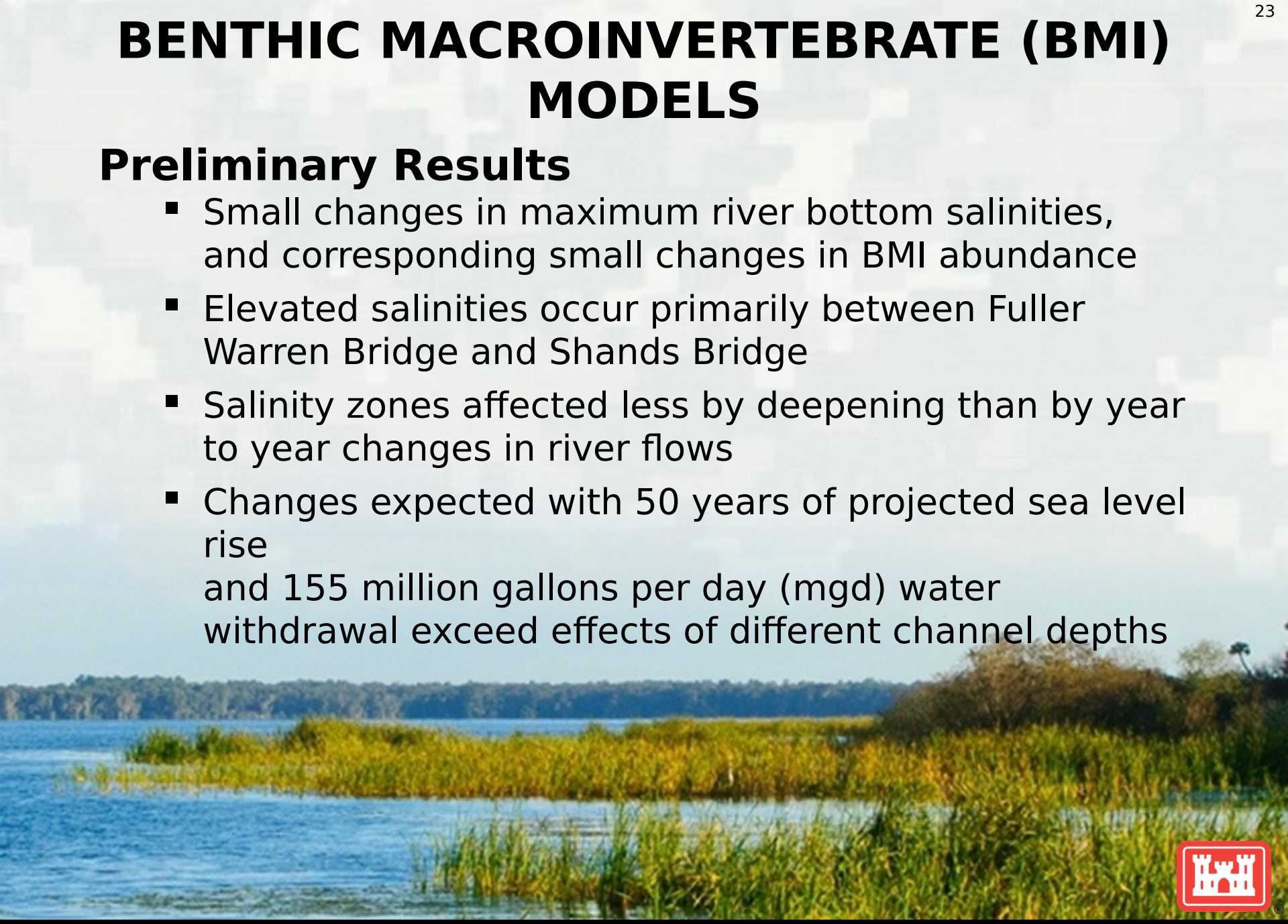




BENTHIC MACROINVERTEBRATE (BMI) MODELS

Preliminary Results

- Small changes in maximum river bottom salinities, and corresponding small changes in BMI abundance
- Elevated salinities occur primarily between Fuller Warren Bridge and Shands Bridge
- Salinity zones affected less by deepening than by year to year changes in river flows
- Changes expected with 50 years of projected sea level rise
  and 155 million gallons per day (mgd) water withdrawal exceed effects of different channel depths



FISH MODEL

Evaluation Topic

- Fish Habitat area

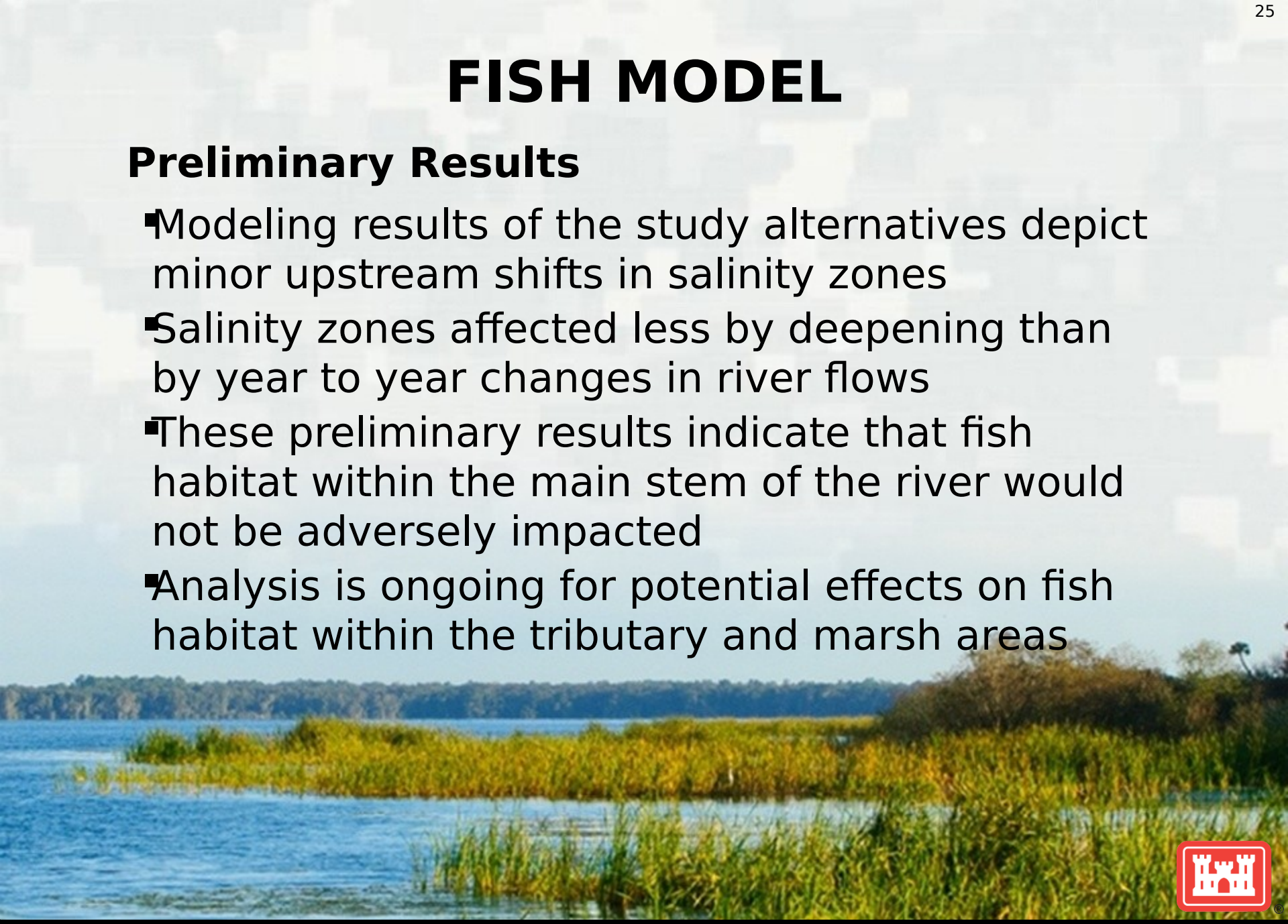
Evaluation Methods

- Changes in area of each salinity category
- Changes in SAV cover
- Fish species require various salinity levels for different stages in their life cycle

FISH MODEL

Preliminary Results

- Modeling results of the study alternatives depict minor upstream shifts in salinity zones
- Salinity zones affected less by deepening than by year to year changes in river flows
- These preliminary results indicate that fish habitat within the main stem of the river would not be adversely impacted
- Analysis is ongoing for potential effects on fish habitat within the tributary and marsh areas



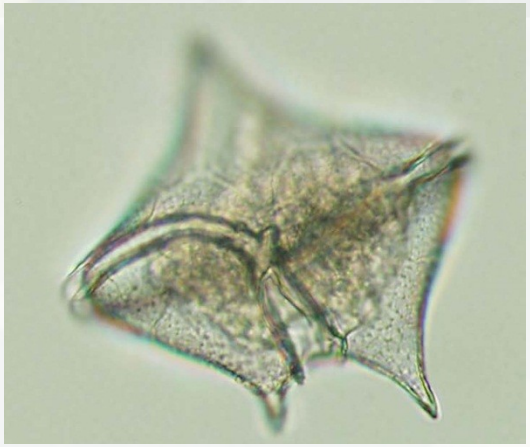
PLANKTON MODELS

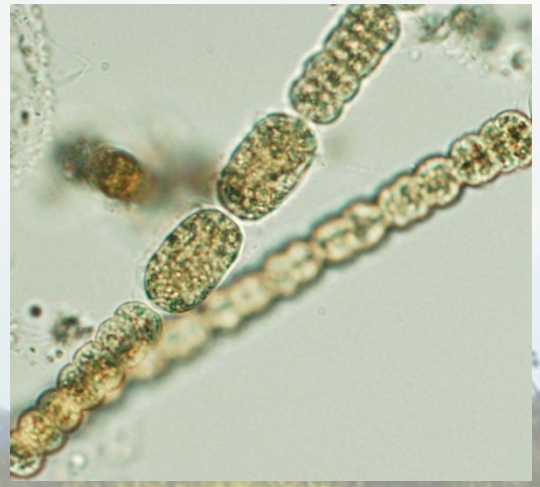
Evaluation Topics (algal bloom metrics)

- Marine algal blooms
- Nitrogen (N) loading via N_2-fixation
- Freshwater bloom magnitude (chlorophyll-a maximum/dissolved oxygen minimum)
- Freshwater bloom duration

Evaluation Method

- Regression models based on water age





PLANKTON MODELS

Preliminary Results

- Preliminary results are inconclusive
- Evaluation and analysis is ongoing

WATER QUALITY EVALUATION

Evaluation Topics

- Chlorophyll-a (for comparison to plankton empirical model)
- Dissolved Oxygen (relative to TMDL)

Evaluation Method

- EFDC Model
- CE-QUAL-ICM Model

EFDC-CEQUAL-ICM Model Mesh

Model conditions

- 2,707 cells, 6 vertical layers
- Model output variables
  - Water surface elevation
  - Velocity
  - Salinity
- EFDC output delivered to CEQUAL-ICM water quality model
- Model is calibrated and alternative runs are in-progress

PRELIMINARY RESULTS SUMMARY

- **Circulation model effectively simulates water movement, elevation and salinity**
- **The ecological models indicate some effects with study alternatives (including the no action alternative)**
- **Preliminary effects appear greatest for SAV and wetlands**
- **Effects due to sea level rise and water withdrawal at 50-year horizon generally exceed initial effects of any study alternative**
- **Additional alternative simulations and analysis are underway or planned**

JACKSONVILLE HARBOR DEEPENING STUDY WEBSITE

WWW.SAJ.USACE.ARMY.MIL

QUESTIONS?

Certain photos courtesy of the St. Johns River Water Management District and